CLAIMS

That which is claimed is:

1. A slurry polymerization process in which solid polyolefin particles are formed in a liquid diluent, said process comprising:

introducing a liquid diluent to a loop reaction zone;

introducing a catalyst to the loop reaction zone, the catalyst being capable of polymerizing said olefin monomer;

introducing an olefin monomer to the loop reaction zone through a plurality of monomer feeds, wherein the olefin monomer is introduced so that the concentration of the olefin monomer within the loop reaction zone is within a desired range;

polymerizing the olefin monomer to form a fluid slurry of solid polyolefin particles in the liquid diluent; and

withdrawing a portion of the fluid slurry as an intermediate product.

2. A process according to claim 1 wherein the catalyst is introduced through a plurality of catalyst feeds.

3. A process according to claim 1 wherein said portion of the fluid slurry is withdrawn through a plurality of product take-offs.

4. A process according to claim 3 wherein the monomer feeds and the product take-offs are symmetrically arranged around the loop reaction zone.

5. A process according to claim 1 wherein the desired range is 1.05 % or smaller.

6. A process according to claim 1 wherein said plurality of monomer feeds comprises at least one monomer feed per 800 feet of reactor length.

7. A process according to claim 1 wherein said plurality of monomer feeds comprises at least one monomer feed per 18,000 gallons of reactor volume.

8. A process according to claim 1 wherein said fluid slurry has a plurality of monomer concentrations around the loop reaction zone, and the standard deviation of said plurality of monomer concentrations is equal to or less than 0.4 %.

9. A process according to claim 1 further comprising the steps of measuring the concentration of the olefin monomer in the withdrawn portion of the fluid slurry, and adjusting the introduction of the olefin monomer in response to the measured concentration.

10. A process according to claim 9, wherein the introduction of the olefin monomer is adjusted so that a different amount of the olefin monomer is fed at one monomer feed than the amount of the olefin monomer fed at another monomer feed.

11. A process according to claim 1 wherein said loop reaction zone has a volume of more than 20,000 gallons.

12. A process according to claim 1 wherein said loop reaction zone has a volume of more than 30,000 gallons.

13. A process according to claim 1 wherein said loop reaction zone has a volume of 35,000 gallons or more.

14. A process according to claim 1 wherein each of said monomer feeds is separately controlled.

15. A process according to claim 1 wherein said solid polyolefin particles have a molecular weight distribution that is unimodal.

16. A loop reactor apparatus comprising:

a plurality of major segments;

a plurality of upper minor segments;

a plurality of lower minor segments;

wherein each of said major segments is connected at an upper end to one of said upper minor segments, and is connected at a lower end by a smooth lower bend to one of said lower minor segments, such that said major segments and said minor segments form a continuous flow path adapted to convey a fluid slurry;

at least two means for introducing an olefin monomer into the continuous flow path;

means for introducing a polymerization catalyst into the continuous flow path; and

at least two means for removing a portion of the fluid slurry from the continuous flow path.

17. The loop reactor apparatus of claim 16, further comprising at least one means for measuring the concentration of the olefin monomer in the removed portion of the fluid slurry, said measuring means being in fluid connection with said removing means.

18. The loop reactor apparatus of claim 17, further comprising a means for controlling said monomer introducing means, and said measuring means provides a signal indicative of said measured concentration to said controlling means.

19. A loop reactor apparatus comprising:

a first major leg; a second major leg; a third major leg; a fourth major leg; a fifth major leg; a sixth major leg; a seventh major leg; and an eighth major leg; a plurality of minor segments, each segment connecting two of said major legs to each other, whereby said legs and said segments comprise a continuous flow path;

a first monomer feed attached to said first major leg;

a first product take-off attached to the third major leg;

a second monomer feed attached to said fifth major leg;

a second product take-off attached to the seventh major leg; and

at least one catalyst feed attached to one of said legs or segments.

20. The loop reactor apparatus of claim 19, comprising a first and second catalyst feed, wherein:

said first and second monomer feeds are symmetrically arranged around the continuous flow path;

said first and second product take-offs are symmetrically arranged around the continuous flow path; and

said first and second catalyst feeds are symmetrically arranged around the continuous flow path.